may be used to effect separation. With the inventive process operating in the above-indicated pressure range and using higher temperature heat exchange fluids, the separation of ethane from ethylene at a purity level of about 99 mole % or higher can be effected using about 10 to about 500 microchannel distillation sections. On the other hand, conventional ethane/ethylene separations at pressures of about 10 to about 25 atmospheres using a heat exchange fluid at temperatures in the range of about −150° C. to about 0° C. typically require about 200 distillation sections. The cost of additional distillation sections using conventional processes to operate at the higher pressures and temperatures indicated above for the inventive process would typically be significantly higher than with the inventive process. On the other hand, the cost of additional microchannel distillation sections with the inventive process are typically relatively low. The use of higher temperature heat exchange fluids with the inventive process should lower the operating cost of the process.

[0183] A disadvantage of conventional hardware used for vapor-liquid contacting unit operations is that conventional trays and packing may be difficult to operate or operate less efficiently when the process is operated at feed rates below about 50% design capacity. An advantage of the present invention relates to an ability to operate the process in a modular fashion for effective operation at a wide range of capacities. The inventive process may be designed with numerous modules and sections of modules. Turndown operation can be achieved with directing flows to active modules and sections of modules, where the process channels are operating efficiently at close capacity. For example, an overall process may be operating at 50% capacity, but the active microchannel distillation units may be operating at 80-90% capacity. In one embodiment, the overall process may be operating at a capacity that is at least about 10% less than the operation in at least one microchannel unit. For example, the overall process may be operating at about 50% or less capacity while one or more of the microchannel distillation units may be operating at about 60% of capacity or higher. Thus, in one embodiment the microchannel distillation assembly may comprise a plurality of microchannel distillation units, some of the microchannel distillation units being active and some of the microchannel distillation units being inactive.

[0184] In one embodiment, the present invention may provide for the separation of ethylene from a fluid mixture comprising ethylene and ethane in a microchannel distillation column or apparatus having a height of up to about 20 meters, and in one embodiment up to about 10 meters, and in one embodiment up to about 5 meters, and in one embodiment up to about 3 meters, with purity levels of ethylene of at least about 95% by volume, and in one embodiment at least about 98% by volume, and in one embodiment at least about 99% by volume.

[0185] In one embodiment, the inventive process exhibits a microchannel fast response to a step change. The test criterion for determining whether a system exhibits a microchannel fast response to a step change may be measured by either of the following Tests 1 or 2.

Test 1

[0186] The steady-state distillate and bottoms compositions and flow rates are measured. Then a step change decrease of 10% is made to the total inlet flow rate fed to the distillation column (time=0 minutes). After twenty minutes (t=20 minutes), the distillate and bottoms compositions and flow rates are measured. After 6 hours (time=380 minutes), the distillate and bottoms compositions and flow rates are measured again. Changes in flow rate and mole fraction of key light (the component which just prior to time=0 minutes has the largest mole fraction in the distillate) are compared for the time interval 0 to 20 minutes and 0 to 380 minutes in the bottoms and in the distillate. If the change in flow rate or mole fraction of light key for the time interval 0 to 20 minutes is greater than 80% of the change in flow rate or mole fraction of light key for the time interval 0 to 380 minutes for either the bottoms or distillate product streams, then the device exhibits microchannel fast response to a step change.

Test 2

[0187] The steady-state distillate and bottoms compositions and flow rates are measured. Then a step change increase of 10% is made to the mole fraction of light key (the component which just prior to time=0 minutes has the largest mole fraction in the distillate) in the stream fed to the distillation column (time=0 minutes). After twenty minutes (time=20 minutes), the distillate and bottoms compositions and flow rates are measured. After 6 hours (time=380 minutes), the distillate and bottoms compositions and flow rates are measured again. Changes in flow rate and mole fraction of key light (the component which just prior to time=0 minutes has the largest mole fraction in the distillate) are compared for the time interval 0 to 20 minutes and 0 to 380 minutes in the bottoms and in the distillate. If the change in flow rate or mole fraction of light key for the time interval 0 to 20 minutes is greater than 80% of the change in flow rate or mole fraction of light key for the time interval 0 to 380 minutes for either the bottoms or distillate product streams, then the device exhibits microchannel fast response to a step change.

[0188] The inventive process may be employed in a process for making liquefied natural gas. This is illustrated in **FIG. 41**. The separation system illustrated in **FIG. 41** involves the use of a series of cascaded microchannel distillation units for separating water and higher molecular weight materials such as ethane or ethylene, propanes or propylene, and butanes or butylene, from the raw natural gas. Referring to **FIG. 41**, separation system **1000** includes the use of bulk liquids separator **1010**, microchannel distillation columns or apparatuses **1020**, **1030**, **1040** and **1050**, condenser **1060**, compressor **1065**, valve **1070**, and expansion devices **1075**, **1080**, **1085** and **1090**. Each of the microchannel distillation columns or apparatuses **1020**, **1030**, **1040** and **1050** may be similar in design and operation to the microchannel distillation columns or apparatuses **110**, **210** or **310** discussed above. A raw natural gas product mixture comprising methane, water and hydrocarbons containing two or more carbon atoms, enters bulk liquids separator **1010** through line **1009**. Hydrocarbons of about 5 carbon atoms and above are separated from the raw natural gas product mixture and advanced to storage or further processing through line **1012**. The remainder of the raw natural gas product mixture containing water and hydrocarbons of 1 to about 4 carbon atoms is advanced through line **1011** to microchannel distillation apparatus **1020**. Water is separated from the product mixture in microchannel distil-